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G. MOUNTJOY ET AL
ANGLE SENSITIVE SWITCH

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FIG.1.

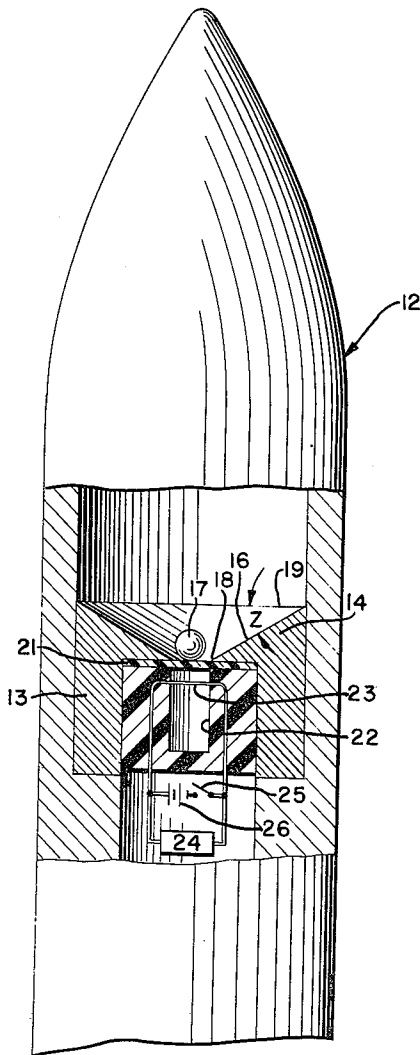


FIG.2.

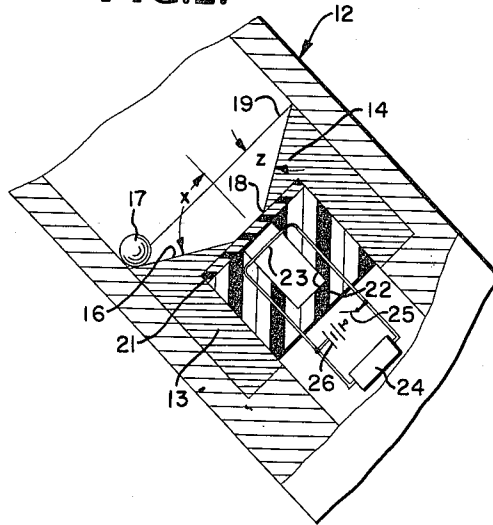


FIG.3.

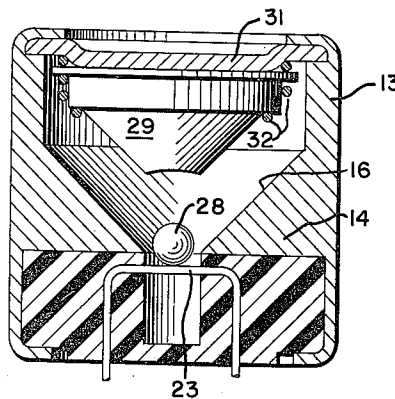
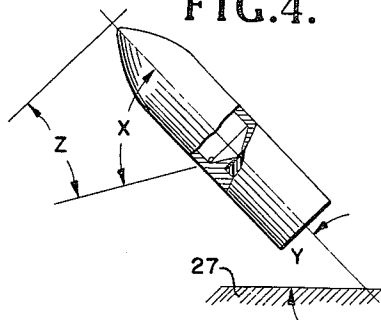


FIG.4.



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ANGLE SENSITIVE SWITCH

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4 Claims. (Cl. 102-70.2)

This invention relates generally to an arming switch for use in ordnance fusing mechanisms and more particularly to a new and improved inertia actuated switch which is operable only when it is oriented above a predetermined angle of elevation.

In brief, the switch of the instant invention comprises an electrically conducting frangible member which is connected across the explosive initiator within the projectile to short the initiator and maintain it in the unarmed condition. A guideway is disposed above the frangible member and receives a free floating member adapted to be driven by inertial set back forces against the frangible member to fracture it as the projectile is fired and unshort the initiator if the projectile is disposed at an angle of elevation greater than a predetermined critical value.

One object of this invention is the provision of an unshorting switch which operates to arm a fuse in a projectile when it is fired at an angle exceeding a predetermined minimum.

Another object is the provision of a novel switch which is simply constructed and operates in an efficient positive manner.

These and many other objects will become more apparent when the following description is read in the light of the attendant drawings wherein like or similar parts are represented by like reference numerals throughout the various figures and in which:

FIG. 1 is a view partly in section of a projectile containing an unshorting switch and embodying the principles of this invention and disposed at an elevational angle greater than the critical value;

FIG. 2 is a sectional view of the switch of FIG. 1 disposed at an angle less than the critical value;

FIG. 3 is a view in section of a modified switch illustrative of a second embodiment of this invention; and

FIG. 4 is a diagrammatic representation of a projectile in position to be fired from its launching site.

Referring to the drawing for a more complete understanding of the invention, FIG. 1 illustrates an unshorting switch disposed within a projectile 12. The housing 13 of the switch is arranged so that its axis is parallel to the longitudinal axis of the projectile 12. An inwardly projecting annular member 14 is fixed to the interior of the housing to form an interior frusto conical guideway 16 which is adapted to receive a heavy free floating ball 17. The base of the conical guideway is forward of the apex of the guideway within the projectile so that when the projectile 12 is aimed at an angle exceeding a critical angle, the apex 18 is lower than any point on the base 19. On the other hand, at elevational angles lower than the critical angle, the base is lower than the apex.

Disposed beneath the opening in the apex 18 of guideway 16 is a diaphragm 21 upon which the ball 17 rests when the switch is disposed at an angle of elevation exceeding the predetermined critical minimum angle. Diaphragm 21 although shown on the drawing as composed of insulating material suitable for the purpose such as rubber or any of the synthetic varieties thereof may be composed of a thin sheet of metal possessing the necessary frangible qualities. The diaphragm possesses sufficient strength to support the ball when it is at rest and no exterior forces other than the force of gravity are acting upon it. If the projectile is fired while the ball is resting on the diaphragm, the inertial set back forces are suffi-

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cient to drive the ball through the diaphragm and into the bore 22. A frangible electrical conductor 23 is disposed across the bore and is electrically connected in shunting relation to the squib or initiator 24 to render it safe even if the firing switch 25 between a power source 26 and the squib is closed prematurely.

When the projectile is oriented so that it is at an elevational angle greater than the critical angle, the apex 18 is lower than the base of the conical guideway. Accordingly, the ball 17 is driven through the bore 22 by the set back force produced upon firing of the projectile, rupturing the diaphragm 21 and breaking member 23 as it moves rearwardly.

However, if the projectile is at a small angle of elevation, ball 17 assumes the position indicated in FIG. 2 and the set back force will not drive it through the diaphragm and member 23 since the inertia forces generated by the firing of the projectile will act along the axis of the projectile tending to press the ball tightly against the sides of guideway 16.

The critical angle is determined by the angle x formed between the axis of the conical guideway and its side which is a complementary angle with the base angle z . When the angle x is relatively small, the critical angle y formed between the earth or firing platform 27 and the axis of the projectile is also small. That is, when angle x is small this switch will unshort the squib even when the projectile is fired at relatively small elevational angles. Since the axis of the projectile and the axis of the frusto conical guideway are parallel, the critical angle y is equal to the angle x or complementary to angle z .

It should be apparent from the foregoing that when the firing angle of elevation exceeds angle x , the apex or discharge end of the guideway is lower than the base so that the ball will be resting on diaphragm 21 and the switch will be unshorted by set back forces created as the projectile is fired. At smaller elevational angles, the base is lower than the apex of the guideway and the switch is not operated by set back.

In the modification shown in FIG. 3, the free floating member is relatively light weight and it is forced through the conductor by an inertia ram.

In this embodiment, the switch includes a casing 13 and a member 14 forming a conical guideway for the ball 28. A frangible conductor 23 is disposed below the guideway. The diaphragm is omitted in this embodiment because the weight of ball 28 is insufficient to accidentally break the conductor 23.

An inertia ram 29 is yieldably secured to the cover 31 of the casing by a soft spring 32 so that upon firing the projectile, the ram is driven rearwardly with respect to the casing. The ram 29 is sufficiently heavy to drive ball 28 through member 23 when the projectile is fired with the ball in the initial position shown in FIG. 3, thereby opening the short circuit across the squib and arming the fuse. At smaller elevational angles, the ball will be resting near the base of the conical guideway and the ram will merely tend to urge it into closer contact with the guideway rather than drive it through the discharge end of the guideway at its apex.

Although this invention has been described in but a few preferred embodiments, it is not so limited as it is susceptible of many alterations and modifications.

Accordingly, the invention is not to be construed as limited in any way by the illustrative examples set forth herein but is to be defined only the scope of the appended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a projectile having an electrically operated and normally short circuited squib, an improved switch for unshorting said squib when said projectile is fired at an

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elevational angle greater than a predetermined minimum value comprising; a frangible electrical conductor short circuited across said squib, a hollow frusto conical guideway axially aligned with the projectile and having the base thereof disposed forwardly of the apex in said projectile whereby the apex of said frusto conical defines an outlet adjacent to said conductor, a frangible diaphragm disposed between said conductor and the outlet of said guideway, free floating means disposed in said guideway and adapted to move through said outlet to fracture said diaphragm and said conductor when said projectile is fired at an angle of elevation greater than a predetermined minimum.

2. In a projectile having an electrically operated squib, and a short circuit across said squib, an improved switch for unshorting said squib when said projectile is fired at an elevational angle greater than a predetermined minimum value comprising; a frangible electrical conductor serially connected in the short circuit across said squib, a hollow frusto conical guideway having an outlet at the apex thereof and axially aligned with the projectile, said conductor initially bridging the outlet of said guideway, free floating means disposed within said guideway and resting upon said conductor only when the apex of said guideway is the lowermost portion thereof, an inertia operated ram yieldably carried by said switch whereby said ram drives said free floating means through said conductor severing said conductor thereby opening said short circuit only when said means is resting on said conductor as the projectile is fired.

3. An inertia operated switch for opening a circuit which comprises; a casing, an inwardly projecting member fixed to said casing and forming a tapered guideway having an outlet at one end thereof, said switch being in the

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operative position when the outlet is in the lowermost of said guideway and in the inoperative position when the casing is tilted so that the outlet is not lowermost, a frangible diaphragm disposed about said outlet to initially close it, a frangible electrically conducting element disposed beneath said diaphragm and serially connected in the circuit to be broken, free floating inertial means disposed within said casing for rupturing said diaphragm and said electrically conducting member when said switch is suddenly accelerated while it is in said operative position.

4. In a projectile having an electrically operable and normally short circuited squib for igniting a main explosive charge, a switch for unshorting said squib when said projectile is fired at an elevational angle greater than a predetermined angle and comprising; a casing, a frangible electrical conductor serially connected in a short circuit across said squib, a member fixed interiorly of said casing forming a hollow frusto conical guideway having a base angle and an outlet at the apex thereof, free floating means disposed in said guideway and adapted to fracture said conductor when said projectile is fired at an angle of elevation greater than an angle complementary to the base angle of said conical guideway thereby to unshort the squib.

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